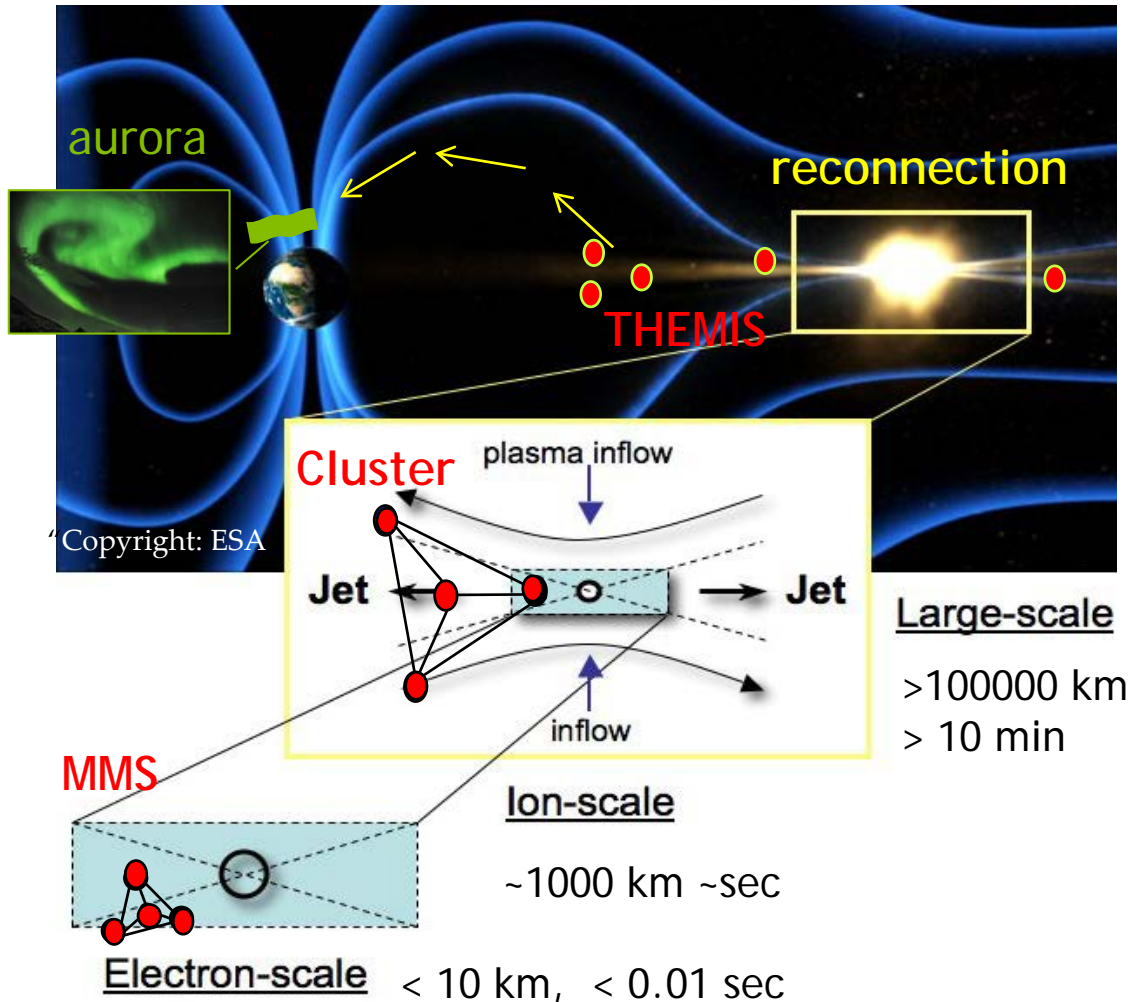


Magnetospheric drivers and potential synergies between GDC and European assets

Rumi Nakamura

*Space Research Institute,
Austrian Academy of Sciences*

MAGNETOSPHERIC DRIVERS ARE MULTI-SCALE PROCESSES



Night-side magnetospheric processes are essential drivers:

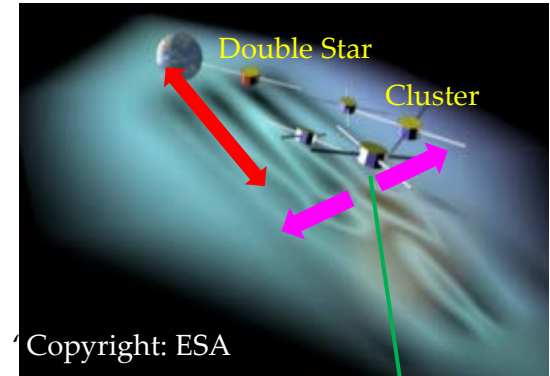
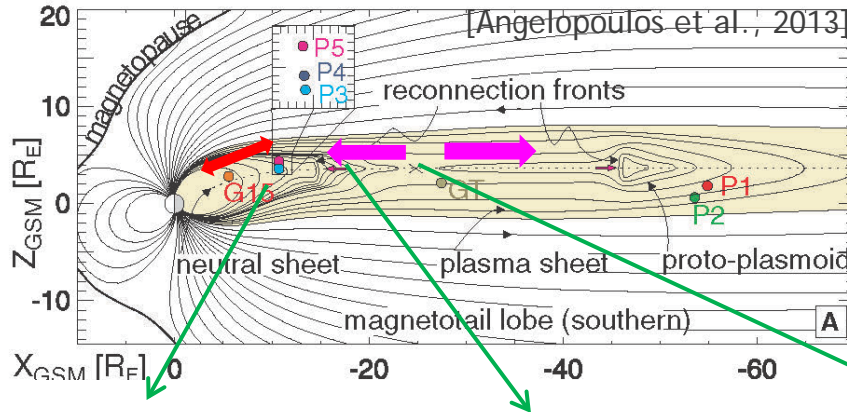
Magnetic reconnection, plasma jets, field-aligned currents, waves, injections

- THEMIS (2007-) fluid plasma physics
- Cluster (2001-) ion plasma physics
- MMS (2015-) electron plasma physics

→ Multi-scale processes
→ Cross-scale coupling important

MAGNETOTAIL DRIVERS

Propagation "along" as well as "across" the tail

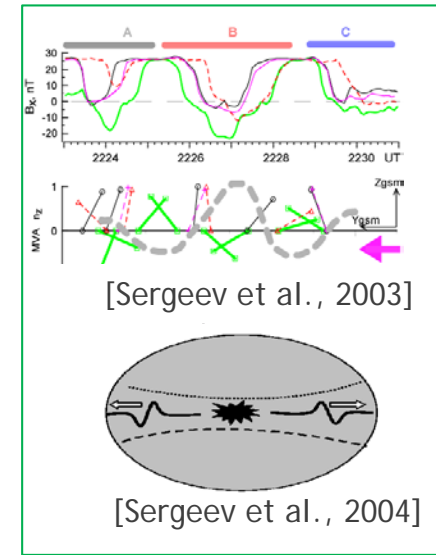
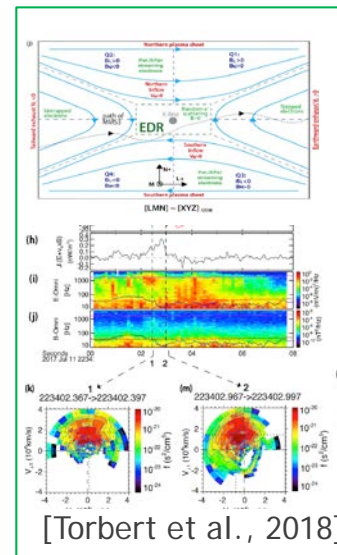
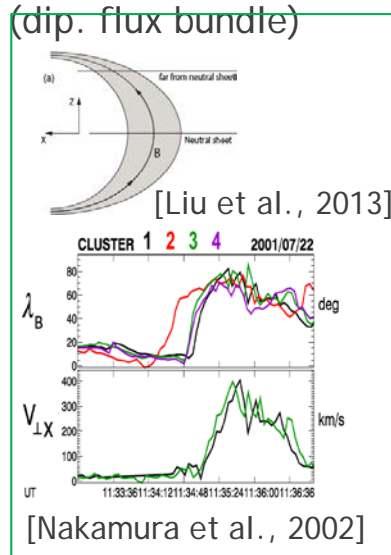
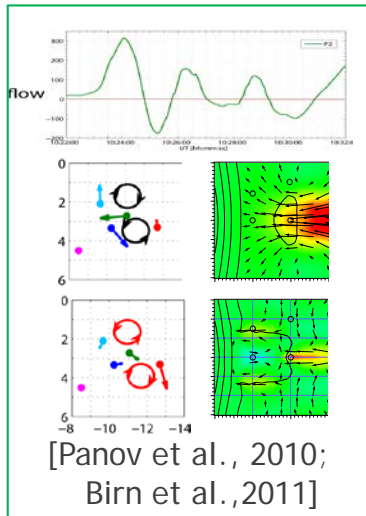


flow braking/bouncing

dipolarization front (dip. flux bundle)

magnetic reconnection

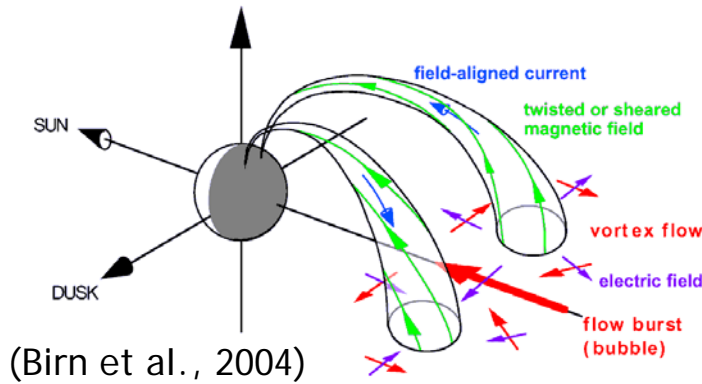
current sheet flapping



MESO-SCALE MAGNETOSPHERIC DRIVER

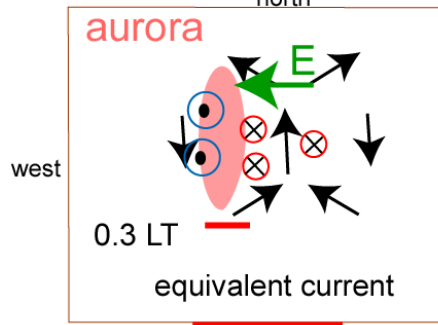
Localized earthward fast plasma flows in magnetosphere

→ localized ionospheric flow & current pattern, field aligned current, aurora



(Birn et al., 2004)

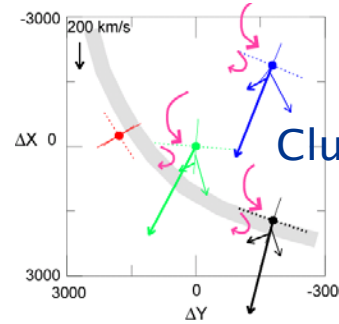
Ionosphere
north



1 LT => 3 RE

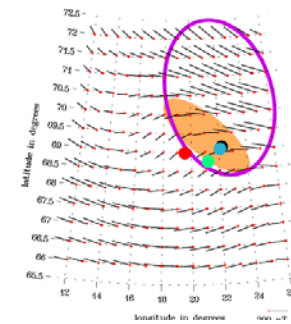
dawn-to-dusk electric field and/or enhanced conductivity and confined f.a.c.

magnetosphere



Plasma flow

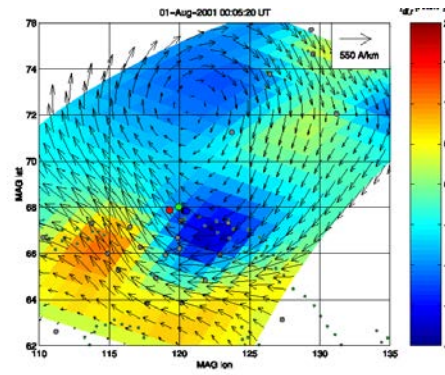
ionosphere



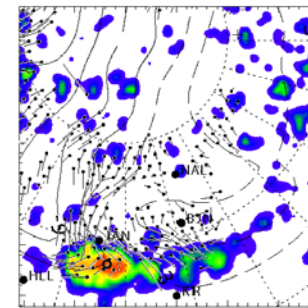
MIRACLE network

Equivalent current

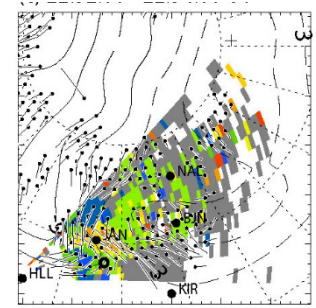
(Nakamura et al., 2005)



equivalent current
(Jusola et al., 2009)



IMAGE



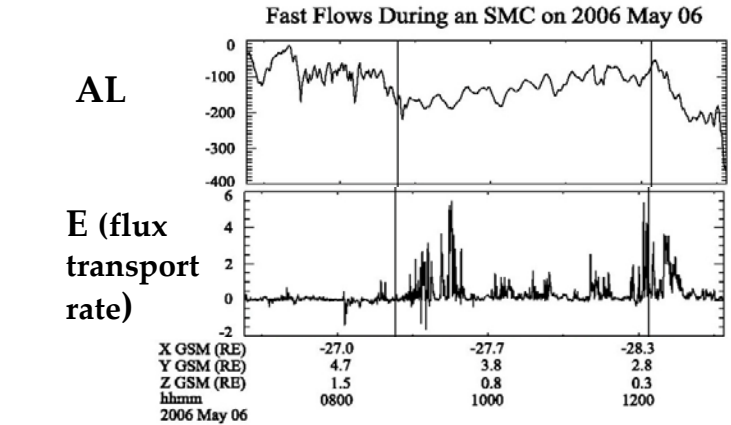
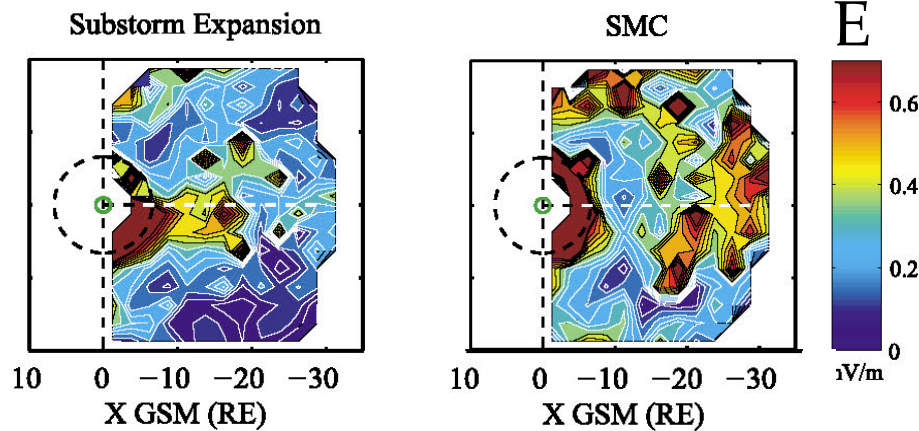
CUTLASS

Aurora & ionospheric flow vorticity
(Grocott et al., 2004)

DIFFERENT MAGNETOSPHERE STATE → DIFFERENT RESPONSE

Steady magnetosphere convection (SMC)

Fast flows (or E) do not penetrate near-Earth

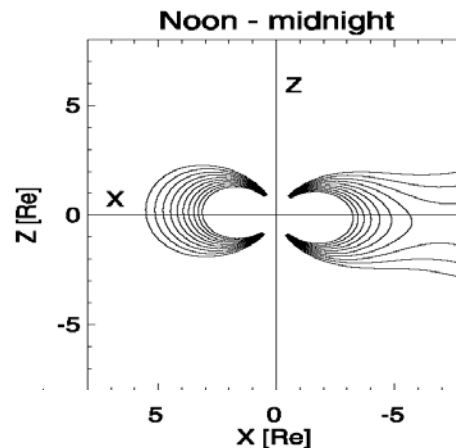


[Kissinger et al., 2012]

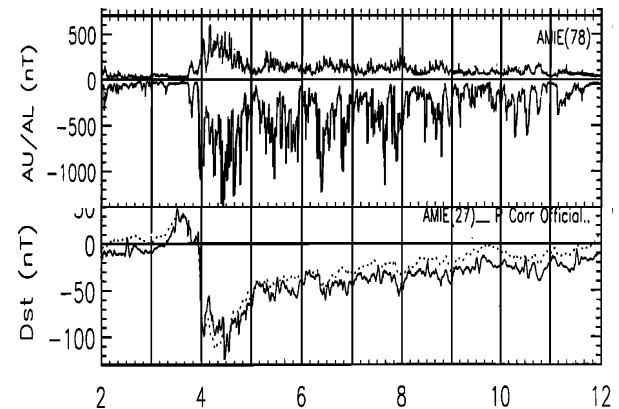
Storm-time substorm

Earthward intrusion of tail current

→ Thin current sheet in partial ring current region



[Pulkkinen et al., 2006]

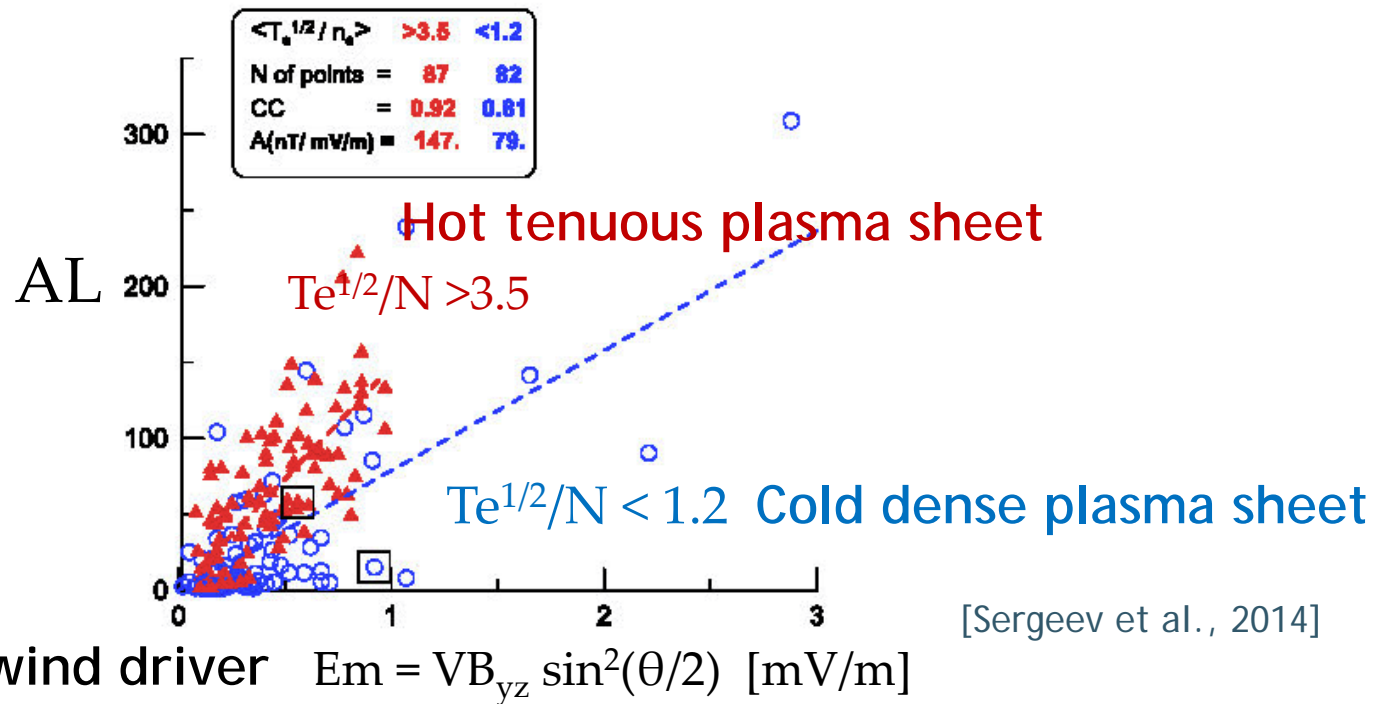


[Knipp et al., 1999]

MAGNETOTAIL PLASMA CONDITION CONTROLS EFFICIENCY OF M-I COUPLING

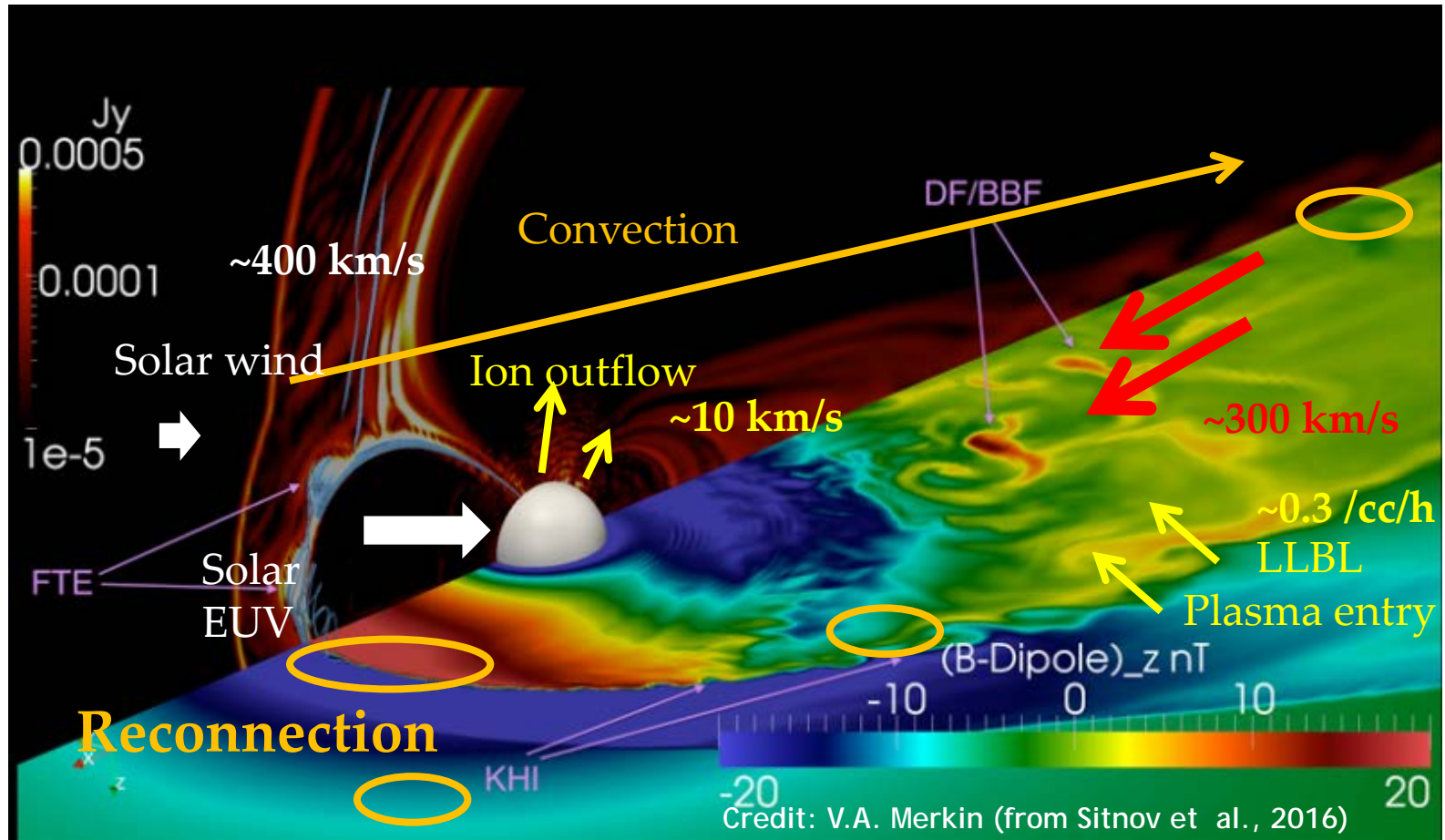
Cold dense plasma sheet \rightarrow ineffective solar wind driver

- Slower Alfvén velocity
- Less field aligned acceleration (potential drop $\Phi_{||} \sim j_{||} T_e^{1/2} / N$)



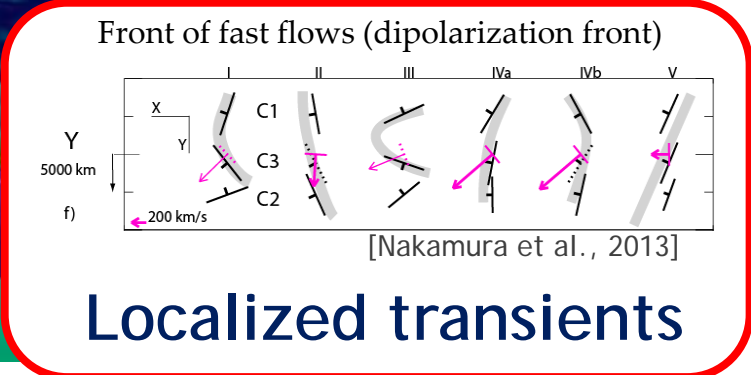
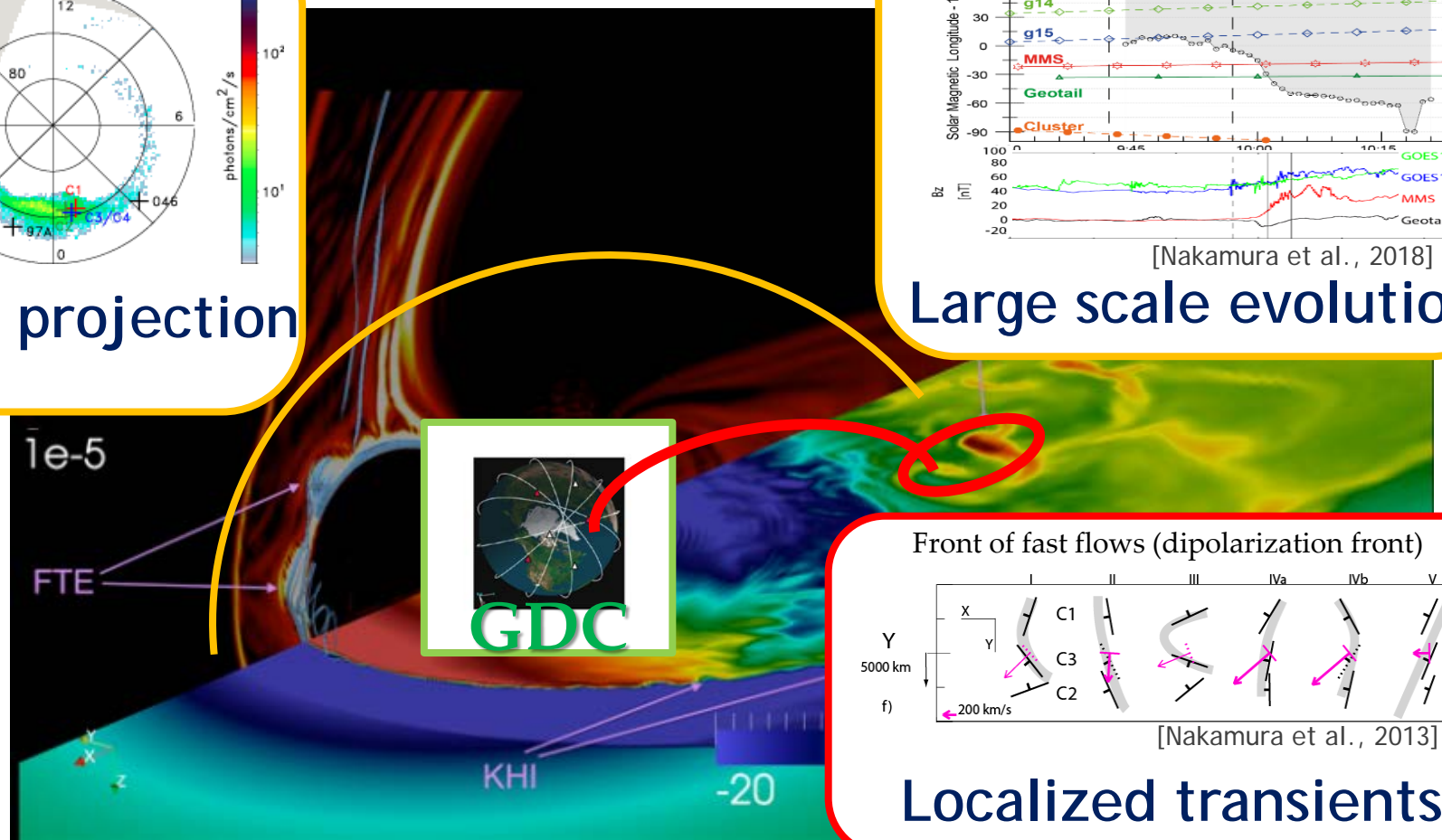
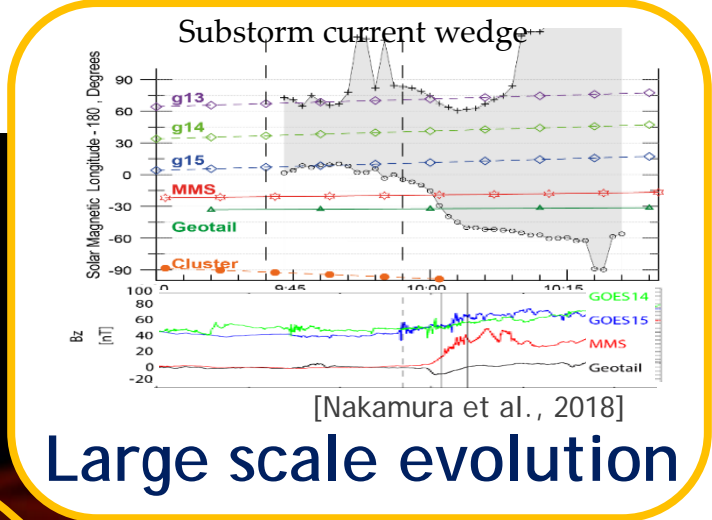
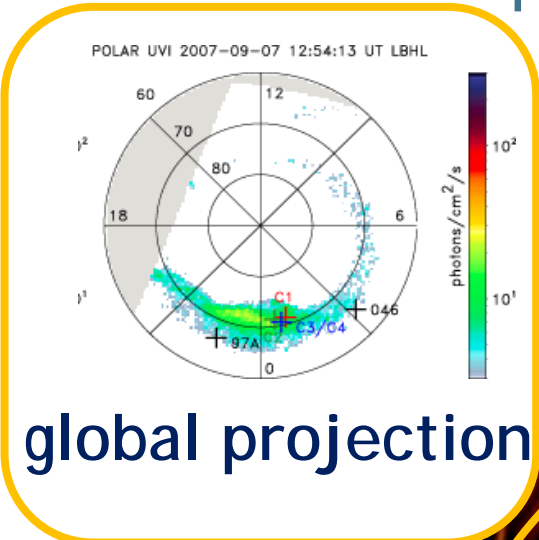
\rightarrow Plasma sheet plasma condition controls ionospheric response to solar wind driver

MAGNETOSPHERE CONTROLLED BY DIFFERENT PROCESSES WITH DIFFERENT TIME-SCALES



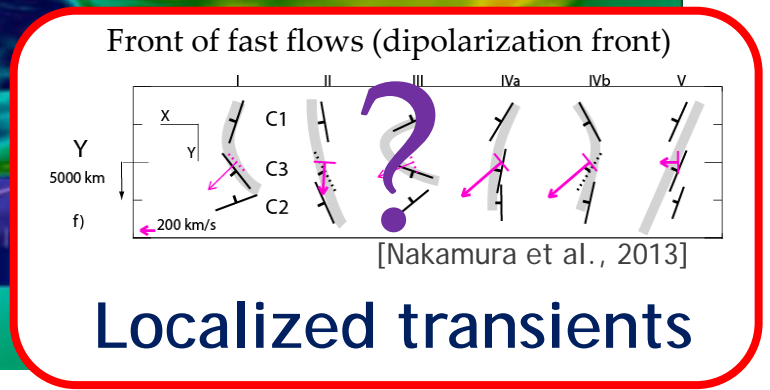
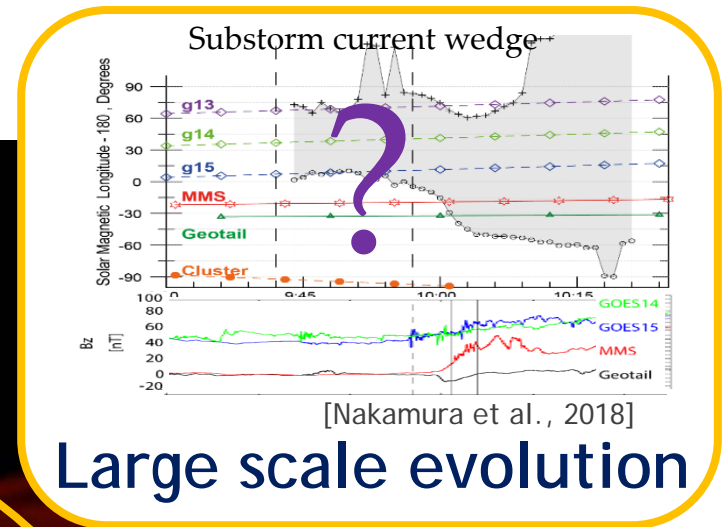
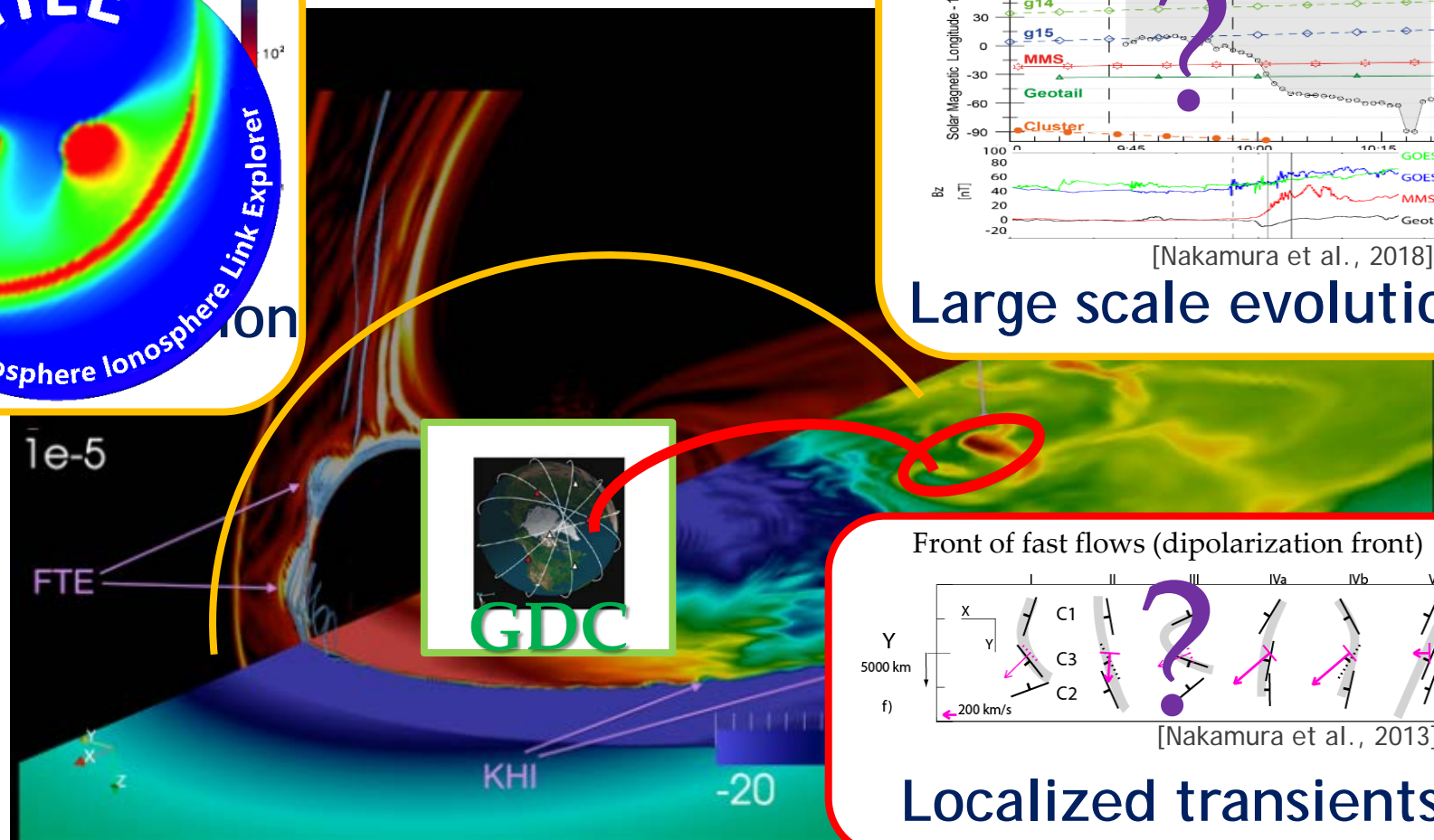
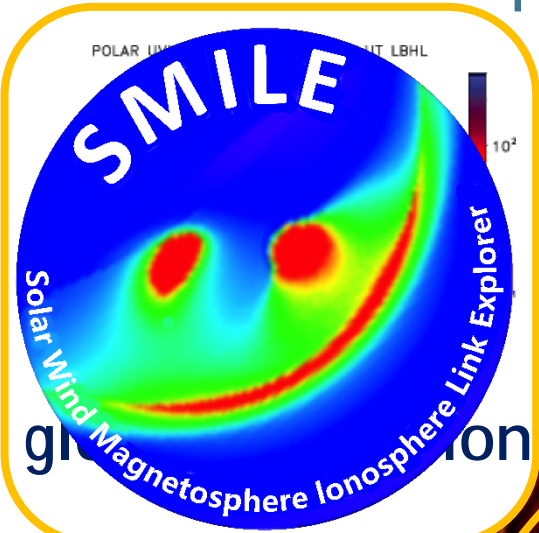
Magnetospheric monitor essential for SW/M-IT coupling studies

MAGNETOSPHERIC ASSETS RELEVANT TO GDC SCIENCE



Magnetospheric monitor essential for SW/M-IT coupling studies

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